

8(5).

SOV/161-58-3-4/27

AUTHOR:

Gorban', A. P., Candidate of Technical Sciences, Instructor  
(Moscow)

TITLE:

On the Use of the Effect of Mutual Induction for the Transformation of a Single-phase Current Into a Three-phase One and Vice Versa (Ob ispol'zovanii yavleniya vzaimnoy induktsii dlya preobrazovaniya odnofaznogo toka v trekhfaznyy i obratno)

PERIODICAL:

Nauchnyye doklady vysshey shkoly. Elektromekhanika i avtomatika, 1958, Nr 3, pp 39-44 (USSR)

ABSTRACT:

In the introduction it is pointed out that this idea is not new, but that it has hitherto only rarely been dealt with in scientific literature. The author worked out a wiring circuit which transforms both three-phase- into single-phase current and also single-phase- into three-phase current. The basic wiring system is given (Fig 1); it consists of a transformer and a three-phase motor. A sectional view of the transformer with its windings is shown (Fig 2). If the device is connected to a single-phase mains, the transformer produces the necessary phase shifting for the three phases of the three-phase current motor, or the three-phase current of the generator is transformed by the transformer into a single-phase current.

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On the Use of the Effect of Mutual Induction for the Transformation of a Single-phase Current Into a Three-phase One and Vice Versa

By vector analysis the voltages, the resistance of the motor, and the amperages in the phases are then investigated (Fig 3). The parameters of the transformer warranting a phase shift of  $120^\circ$  are derived, and the coefficients of inductive coupling are determined. The condition for the stability of the phase position is investigated and a vector diagram of voltages and currents is given (Fig 4). Finally, an oscillogram of the phases of a three-phase current motor is given (Fig 5) for the case in which the device is fed from a single-phase mains. Experimental results are given by a table. There are 5 figures, 1 table, and 6 references, 5 of which are Soviet.

This article was recommended for publication by the Katedra elektrotekhniki Moskovskogo lesotekhnicheskogo instituta (Chair for Electrical Engineering at the Moscow Institute for Forestry Engineering)

ASSOCIATION: Kafedra elektrotekhniki Moskovskogo lesotekhnicheskogo instituta (Chair for Electrical Engineering at the Moscow Institute for Forestry Engineering)

Card 2/3

SOV/161-58-3-4/27

On the Use of the Effect of Mutual Induction for the Transformation of a Single-phase Current Into a Three-phase One and Vice Versa

SUBMITTED: May 16, 1958

Card 3/3

GORBAN', A.P.; TKHORIK, Yu.A.

Device for measuring the capacitance of semiconductor diodes.  
Avtom. i prib. no.2:57-60 Ap-Je '63. (MIRA 18:8)

1. Institut poluprovodnikov AN UkrSSR.

Yevchenko, V. I.; Gorbunov, A. I.; Novikova, L. I.

TITLE: Investigation of the effect of adhesion of photocarriers on the surface of silicon

SOURCE: Fizika tverdogo tela, v. 7, no. 2, 1965, 565-572

adhesion, photoconductivity, photoconductivity relaxation, surface electron transition, recombination, photocarrier adhesion

The purpose of the investigation was to establish the electronic and surface states for which the minority carriers can adhere to the surface. To determine the detailed mechanism of the electronic exchange between the local level and the band which leads to violation of the bipolar nature of the conductivity, and to establish the conditions investigated or to determine the carrier adhesion to the surface. The procedure was used for the study of a silicon sample with a narrow band on the surface. The results of the investigation are presented in the paper.

Cont. 1

L 38615-65

ACCESSION NR: AP5005302

Large amplitude rectangular electric-field pulses. The measurements were made in vacuum ( $\sim 10^{-6}$  torr) on thin samples ( $\sim 300\mu$ ) of p-type silicon ( $\sim 10^3$  ohm-cm,  $\tau_{\text{int}} \sim 10^2$  usec), cut along the (111) plane and etched. A detailed description of the procedure and the equipment, and of data on the band model of the real surface of the silicon, is contained in a separate article (RFTZh v. 10, no. 2, 1965). The results show that the form of the photoconductivity relaxation may be connected with the character of the space-charge surface layer. A model is proposed for the electronic transitions, according to which the accumulation of carriers in the band is due to the "delayed recombination" level. According to this model, illumination transfers the "delayed recombination" levels into pure combination levels, and therefore the long-time relaxation is eliminated by illumination. When the temperature is increased, to the contrary, the number of levels going over to the "delayed recombination" levels increases, in agreement with experiment. It is shown that the effect on the formation of surface states is determined by the character of the surface. The results are discussed in connection with the theory of surface states, and the possibility of their use in semiconductor devices is indicated.

ASSOCIATION: Institut poluprovodnikov AN UkrSSR, Kiev (Institute of Semiconductors)

Card 2/3

LITOVCHENKO, V.G. [Lytovchenko, V.H.]; GORBAN', A.P. [Horban', A.P.];  
KOVASYUK, V.P.

Use of the method of small pulse perturbations in studying a  
real silicon surface. Ukr. fiz. zhur. 10 no.3:287-297. M. '65.  
(MIRA 18:6)

1. Institut poluprovodnikov AN UkrSSR, Kiev.

L 18405-63

EDS

ACCESSION NR: AP3003734

S/0103/63/024/007/0871/0881

47

AUTHOR: Gorban', A. V. (Moscow)

TITLE: Synthesizing controlled systems; alternate solutions of one class of degenerated variational problems. 1

SOURCE: Avtomatika i telemekhanika, v. 24, no. 7, 1963, 871-881

TOPIC TAGS: controllable system, degenerated variational problem

ABSTRACT: In this first part of the article, the variational problem of synthesizing a closed-type controlled system is formulated, and three auxiliary theorems are proved. The simplest class of controlled systems — determinate and completely observable — is dealt with. The problem is mathematically characterized as a nonclassical, degenerated (or in K. Karateodori's term "irregular") where a conditional minimum in a nonparametric form is sought. Considering the kinematic nature of unknown quantities, the conventional

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L 18405-63

ACCESSION NR: AP3003734

analytical method is modified, and a new synthesizing approach is suggested, viz.: in the formulas for the necessary conditions of minimum, in the equivalent variational problem, a part of the auxiliary variables (Lagrange multipliers) is eliminated by using the algebraic set of Euler's equations that are included in the first necessary conditions of minimum; this procedure results in (a) a fundamental Bellman's functional equation and (b) two functional inequalities; the original problem is thus reduced to solving the (a) and (b) simultaneously. Orig. art. has: 26 formulas.

ASSOCIATION: none

SUBMITTED: 04Oct62

DATE ACQ: 02Aug63

ENCL: 00

SUB CODE: IE

NO REF SOV: 003

OTHER: 011

Card 2/2

GORBAN', A.V. (Moskva)

Synthesis of regulated systems and alternativeness of solutions  
for a class of degenerated variational problems. Avtom. i  
telem. 24 no.8:1042-1049 Ag '63. (MIRA 16:8)

(Automatic control)

GORBAN', A.V. (Moskva)

Problem of synthesis of controlled systems. Avtom. i telem.  
24 no.10:1297-1302 0 '63. (MIRA 16:11)

GORBAN, B. G.

AUTHOR: GORBAN' B.G., TEREKHINA, L.P. 109-5-8/22  
TITLE: Evaluation of Generator Frequency Stability. (K voprosu ob ot-  
senke stabil'nosti chastoty generatora, Russian)  
PERIODICAL: Radiotekhnika i Elektronika, 1957, Vol 2, Nr 5, pp 591-596 (U.S.S.R.)

ABSTRACT: A short analysis of the criteria for generator properties is here  
carried out. Relations establishing connection between frequency-  
and phase evaluations of generator stability are derived. It is  
shown how it is possible to compute spectral density, the correla-  
tion function, and the dispersion of the phases during the chosen  
period of observation according to the correlation function of the  
frequency deviations from the mean value or according to the spec-  
tral density of frequency deviations. An example is given for com-  
puting the dispersion of the "phase accumulation" according to a  
given spectral density of frequency deviations. (With 2 Illustra-  
tions and 4 Slavic References).

ASSOCIATION: Not given  
PRESENTED BY:  
SUBMITTED: 30.7.1956  
AVAILABLE: Library of Congress

Card 1/1

GORBAN', B.G.

Dispersion of phase bunching in klystron oscillators stabilized by the automatic frequency-control method. Nauch.dokl. vys.shkoly; radiotekh. i elektron.no.1:200-208 '58.

(MIRA 12:1)

1. Kafedra radiopriyemnykh ustroystv Moskovskogo energeticheskogo instituta.

(Klystrons)

Cham A

sample regulator for milk of lime entering the defecator.  
D. V. Gorbun. *Sobremennye Pross.* 23, No. 6, 38(1961).—  
The installation of an intermediate tank with a cone bottom  
between the milk of lime-measuring tank and the defecator,  
with 15% larger capacity than the measuring tank, permits  
a uniform feed of milk of lime. The discharge valve must  
have a conical shape and should be adjustable by means of a  
screw which is regulated from above the tank. A general  
drawing is shown. V. E. Balkov

GORBAN', D.V., YEFIMOV, F.A.

Sugar - Manufacture and Refining

Industrial capacity of filter presses. Sakh. prom. 26 no. 3, 1952

Monthly List of Russian Accessions, Library of Congress, June 1952. UNCLASSIFIED.

GORBAN', D.V.

Our method of juice purification. Sakh.prom.30 no.1:44-45 Ja '56.  
(MLRA 9:6)

1.Sakharnyy saved ineni Stalina.  
(Sugar industry)



GOMRAN', D.V.

Calculating the capacity of crystallizers and centrifugals for second massecuite. Sakh.prom. 30 no.8:24-27 Ag. '56. (MLRA 9:11)

1. Sakhar'nyy zavod imeni Stalina.  
(Centrifuges) (Sugar industry--Equipment and supplies)

GORBAN', D.V.

Checking the alkalinity of the juice of second carbonation. Sakh.  
prom. 30 no. 9; 58 S '56. (MIRA 10:3)

1. Sakharany saved imeni Stalina.  
(Sugar industry)

GORBAN' P. V.

Intensification of industrial processes. Sakh.prom. 30 no.10:43-47  
0 '56. (MIRA 10:1)

1. Sakharnyy zavod imeni Stalina)  
(Sugar industry)

GORBAN', D.V.

Intensify the work of plant laboratories. Sakh.prom. 31 no.3:10-  
11 Mr '57. (MIRA 10:4)

1. Sakharnyy saved imeni Stalina.  
(Sugar industry)

GORBAN', D.V.; TVERDOKHLEBOV, L.S.

Increasing the Yield of bleached sugar. Sakh.prom. 31 no.7:20-23  
J1 '57. (MLRA 10:8)

1. Sakharnyy zavod imeni Stalina.  
(Sugar industry)

GORBAN', D.V.

Several causes of lowering of the quality of brown sugars.  
Sakh.prom. 33 no.7:22-24 J1 '59. (MIRA 12:11)

1. Sakharney zavod imeni Stalina.  
(Sugar manufacture)

GORBAN', D.V.

Lowering the sugar content of molasses. Sakh.prom. 36 no.5:19-23  
Mg '62. (MIRA 15:5)

1. Lokhvitskaya gruppovaya laboratoriya.  
(Sugar manufacture)

GORBAN', D. V.

Flocculation characteristics of the affination runoff sirup  
of unrefined cane sugar. Sakh. prom. 36 no.10:20-21 0 '62.  
(MIRA 15:10)

1. Lkhvitskaya gruppovaya laboratoriya.

(Sugar manufacture)



GORBAN', D.V.

Importance of selecting the optimum system for juice purification  
and of the method of crystallization. Sakh.prom. 37 no.2:11(91)-  
14(94) F '63. (MIRA 16:5)

1. Lokhvitskaya gruppovaya laboratoriya.  
(Sugar manufacture)

GORBAN', D.V.

Some observations concerning the "Notes of the technology and economics of sugar manufacture." Sakh. prom. 37 no.3:42-44  
Mr '63.

(MIRA 1614)

1. Lokhvitskaya gruppovaya laboratoriya.  
(Sugar manufacture)

GORBAN', D.V.

~~Nonuniformity of the temperature and concentration of masscouite~~  
in a vacuum apparatus. Sakh. prom. 37 no. 5:14-17 My '63.  
(MIRA 16:6)

1. Lokhvitskaya gruppovaya laboratoriya.  
(Sugar manufacture)

ACCESSION NR: AT4037691

S/2865/64/003/000/0210/0216

AUTHOR: Gorban', G. M.; Kondrat'yeva, I.I.; Poddubnaya, L. T.

TITLE: Gaseous products of vital activity liberated by man in sealed chambers

SOURCE: AN SSSR. Otdeleniye biologicheskikh nauk. Problemy\* kosmicheskoy biologii, v. 3, 1964, 210-216

TOPIC TAGS: respiration, air purification, metabolic waste

ABSTRACT: Experimental studies have shown that a human being in the process of his vital activities liberates a number of toxic gaseous products into the surrounding medium. Thus, for example, a chamber in which a man has been sealed for 24 hours will contain 297 mg of ammonium, 278 mg of carbon monoxide (417 mg for smokers), 504 mg of hydrocarbons, 0.6 mg of aldehydes, 235 mg of ketones, 5 mg of mercaptans and hydrogen sulfides, and 89 mg of fatty acids. Permanent contaminants in the air of the sealed chamber were carbon dioxide, hydrocarbons, aldehydes, and ammonium. The carbon dioxide and hydrocarbons were found only in a gaseous form; the others both in the air and in the condensate. Data accumulated

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ACCESSION NR: AT4037691

in these experiments indicate the necessity of developing effective means of purifying air and of working out standards for permissible limits for the concentration of toxic substances in sealed chambers.

ASSOCIATION: none

SUBMITTED: 00

ENCL: 00

SUB CODE: PH, LS

NO REF SOV: 014

OTHER: 005

Card 2/2

L 11374-67 INT(1) SCTB DD/GD

ACC NR: AT6036499

SOURCE CODE: UR/0000/66/000/000/0066/0068

AUTHOR: Bizin, Yu. P.; Gorban', G. M.; Zinov'yev, V. M.; Pilipyuk, Z. I.;  
Sidorov, K. K.; Solomin, G. I.; Shirskaya, V. A.; Yablochkin, V. D.

33

ORG: none

TITLE: Changes in several physiological indices of the organism in a gas medium  
formed by polymer decomposition [Paper presented at the Conference on Problems of  
Space Medicine held in Moscow from 24 to 27 May 1966]

SOURCE: Konferentsiya po problemam kosmicheskoy meditsiny, 1966. Problemy  
kosmicheskoy meditsiny. (Problems of space medicine); materialy konferentsii,  
Moscow, 1966, 66-68

TOPIC TAGS: toxicology, polymer degradation, central nervous system, liver, closed  
ecological system, air pollution

ABSTRACT: The combined effect on animal organisms of the chemical substances  
formed by the degradation of some 14 polymers at temperatures in excess  
of 40° C was studied in a 25-day experiment.

Analysis of air from the chamber containing 80 laboratory animals showed  
the following: acrylonitrile,  $2.8 \pm 1.7 \text{ mg/m}^3$ ; aldehydes,  $0.02 \pm 0.01$   
 $\text{mg/m}^3$ ; ammonia,  $4.6 \pm 1.3 \text{ mg/m}^3$ ; acetone  $1.07 \pm 0.6 \text{ mg/m}^3$ ; dibutylphtha-  
late,  $3.7 \pm 0.4 \text{ mg/m}^3$ ; sulphur dioxide,  $1.77 \pm 0.8 \text{ mg/m}^3$ ; carbon monoxide,

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ACC-NR: AT6036499

19.1  $\pm$  1.3 mg/m<sup>3</sup>; hydrocarbons, 600  $\pm$  218 mg/m<sup>3</sup>; hydrogen chloride, 2.46  $\pm$  1.2 mg/m<sup>3</sup>; epichlorhydrine, 0.33  $\pm$  0.08 mg/m<sup>3</sup>; ethyl acetate, 1.61  $\pm$  0.6 mg/m<sup>3</sup>; and ethylene glycol, 0.7  $\pm$  0.4 mg/m<sup>3</sup>.

Carbon dioxide content varied up to a maximum of 1%, oxygen content was 21%, and the relative humidity varied from 60 to 80%.

Blood studies conducted on the animals included erythrocyte count, leukocyte count, reticulocyte count, and hemoglobin determinations, as well as duration of bleeding, rate of coagulation, prothrombin time, thrombocyte count, and blood viscosity. Ability to synthesize hippuric from benzoic acid was taken as an index of the functional state of the liver.

In addition, observations were made of behavior and general conditions of the animals, dynamics of weight changes, tolerance to physical stress, and oxygen requirement. Relative weights of internal organs were determined.

The experimental animals were observed preceding, during, and for 14 days after the experiment.

Prolonged continuous exposure of the animals to the chemical substances liberated by the polymers produced nonspecific functional shifts.

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ACC NR: AT6036499

CNS effects included subcortical irritation and weakening of cortical subordination function. This resulted in intersection of extensor and flexor motor chronaxy curves, lowered susceptibility to brain stem hexanol narcosis, and increased tolerance to physical stress.

Peripheral blood studies showed increased erythrocyte, hemoglobin, and thrombocyte counts.

These CNS and peripheral blood shifts were unstable and nonspecific, and should be regarded as an adaptation reaction of the organism to the presence of gases released by polymer materials. This interpretation is supported by full restoration of the altered functions and indices to the initial state within 14 days after the end of the experiment.

It is concluded that the investigated polymers can be used in space cabins so long as the gases they liberate are scrubbed from the cabin air before they attain the maximum permissible concentration for small closed compartments.  
[W.A. No. 22; ATD Report 66-116]

SUB CODE: 06 / SUBM DATE: 00May66

Card 3/3



Gorban', I. S.

USSR/Physics

Card 1/1 Pub. 43 - 17/62

Authors : Gorban', I. S., and Shishlovskiy, A. A.

Title : Anomalous light dispersion in solutions of complex organic compounds

Periodical : Izv. AN SSSR. Ser. fiz. 18/6, 676-677, Nov-Dec 1954

Abstract : The light dispersion in solutions of fluorescein, iodo-eosin, fuchsin, cyanine, rhodamine B, etc., was investigated by means of a combined spectrometer-Rayleigh interferometer. These organic compounds were chosen because of their known simple absorption bands in the visible zone of the spectrum. It was found, in contrast to vapors with lined absorption spectrum, that the dispersion curves of the investigated complex organic compound solutions have an asymmetry within the simple absorption bands and that the maximum of the absorption curve is much better expressed than the minimum. One USSR Reference (1953). Graph.

Institution : The T. G. Shevchenko State University, Physics Faculty, Kiev

Submitted : .....

GORBAN', I. S.

GORBAN', I. S. -- "Investigation of the Anomalous Dispersion of Light in Solutions." Kiev State U imeni T. G. Shevchenko. Kiev, 1955. (Dissertation for the Degree of Candidate of Physicomathematical Sciences.)

SO: Krishnava letopis', No. 4, Moscow, 1956

FD-3209

USSR/Physics - Spectral Analysis of Liquids

Card 1/1      Pub. 153-18/28

Authors      : Gorban' I. S. and Shishlovskiy A. A.

Title        : Two simple spectro-interference methods for studying dispersion in the visible and ultraviolet spectral bands

Periodical   : Zhur. Tekh. Fiz., 25, No 7, 1297-1306, 1955

Abstract    : The first method uses Fresnel diffraction on the boundary of two transparent media. The other possibility consists in measuring of dispersion curves of liquids and solutions without previous knowledge of their refractive index. An assembled Rayleigh type interference meter was used. It is also possible to study this way the anomalous dispersion of light in solutions. Five references.

Institution: --

Submitted   : July 4, 1954

"APPROVED FOR RELEASE: 06/13/2000

CIA-RDP86-00513R000516030006-0

FORNAN, I. S.

APPROVED FOR RELEASE: 06/13/2000

CIA-RDP86-00513R000516030006-0"

GORBAN', I. S. VISHLOVSKIY, A.A.

Rayleigh-type mirror interferometer. Opt. i spektr. 1 no.6:  
811-812 0 '56. (MLRA 9:12)

1. Kiyevskiy Gosudarstvennyy universitet.  
(Interferometer)

GORBAN', I.S.; RIZHOVA, S.M.; SHISHLOVS'KIY, O.A.

Spectral and interference method for the quantitative analysis of  
two- and three-component solutions. Nauk.sop.Kiev.un. 15 no.5:61-66  
'56. (MLRA 10:7)

(Chemistry, Analytic--Quantitative) (Solutions)

"APPROVED FOR RELEASE: 06/13/2000

CIA-RDP86-00513R000516030006-0

SECRET, T S.

APPROVED FOR RELEASE: 06/13/2000

CIA-RDP86-00513R000516030006-0"





GORBAN, I. S.

PRIKHOT'KO, A. F.

24(7)

p-3

PHASE I BOOK EXPLOITATION SOV/1365

L'vov. Universitet

Materialy X Vsesoyuznogo soveshchaniya po spektroskopii. t. 1: Molekulyarnaya spektroskopiya (Papers of the 10th All-Union Conference on Spectroscopy. Vol. 1: Molecular Spectroscopy) [L'vov] Izd-vo L'vovskogo universiteta, 1957. 499 p. 4,000 copies printed. (Series: Its: Fizichnyy sbirnyk, vyp. 3/8/)

Additional Sponsoring Agency: Akademiya nauk SSSR. Komissiya po spektroskopii. Ed.: Gazer, S.L.; Tech. Ed.: Saranyuk, T.V.; Editorial Board: Landberg, G.S., Academician (Resp. Ed., Deceased), Neporent, B.S., Doctor of Physical and Mathematical Sciences, Fabelinakiy, I.L., Doctor of Physical and Mathematical Sciences, Fabrikant, V.A., Doctor of Physical and Mathematical Sciences, Korotkiy, V.O., Candidate of Technical Sciences, Rayvskiy, S.M., Candidate of Physical and Mathematical Sciences, Klimovskiy, L.K., Candidate of Physical and Mathematical Sciences, Miliyanchuk, V.S., Candidate of Physical and Mathematical Sciences, and Glauberman, A. Ye., Candidate of Physical and Mathematical Sciences.

Card 1/30

Sverdlov, L.M. Calculation and Interpretation of the Vibrational Spectra of Olefins	278
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Card 12/30

GORBAN', I.S.; SHISHLOVSKIY, A.A.

Abnormal dispersion of light in dilute solutions. Fiz. sbor. no. 3:  
286-289 '57. (MIRA 11:8)

1. Kiyevskiy gosudarstvennyy universitet im. T.G. Shevchenko.  
(Solution (Chemistry)) (Dispersion)

AUTHOR: Gorban', I. S. 48-22-5-17/22

TITLE: Optical Properties of Carbonate of Alkaline Earths  
(Opticheskiye svoystva sloyev karbonatov  
shchelochnozemel'nykh metallo)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Seriya Fizicheskaya,  
1958, Vol. 22, Nr 5, pp. 607-612 (USSR)

ABSTRACT: Thin layers of various substances customary in  
vacuum-technique are, from the optical point of view,  
forming opaque media consisting of single parts. The  
paper under consideration is devoted to the study of  
the influence of structure conditions on the optical  
properties of carbonate pastes. The author comes to the  
following conclusions: 1. He proved that the character  
of the standard light deviation depends essentially  
on the thickness and density of the coating when light  
passes through a carbonate layer. 2. He suggested an  
optical method with a simultaneous measuring of  
thickness and density of the film of oxide already  
used in the production of oxide cathodes. This method

Card 1/2

Optical Properties of Carbonate of Alkaline Earths

48-22-5-17/22

may be efficient under working conditions in case it is restricted to the measuring of two intensities  $I_{00}$  and  $I_{10}$ ; this can be done easily if the thickness of the layer and its density satisfy some standard conditions. 3. The results achieved reflect apparently the very general regularities, which are typical for opaque media. Professor N. D. Morgulis and lecturer N. G. Nakhodkin, further A. F. Sribnaya cooperated as advisors and helped at the measuring. There are 8 figures and 5 references, 4 of which are Soviet.

ASSOCIATION:

Kiyevskiy gos. universitet im. T. G. Shevchenko  
(State University imeni T. G. Shevchenko, Kiyev)

1. Alkaline earth carbonates---Optical properties

Card 2/2

GORBAN', I.S. [Horban', I.S.]

Characteristics of the absorption spectrum in the region of the  
yellow series of  $\text{Cu}_2\text{O}$ . Visnyk Kyiv.un.no.2.Ser.fiz.ta khim.. no.1:  
45-48 '59. (MIRA 14:8)

(Copper oxide—Spectra)

GORBAN', I.S. [Horban', I.S.]

Optical absorption and structure of energy states of copper oxide.  
Ukr. fiz. zhurn. 5 no.2:281-285 Mr-Apr '60. (MIRA 13:12)

1. Kiyevskiy ordena Lenina gosudarstvennyy universitet im.  
T.H. Shevchenko.

(Copper oxide--Optical properties)

81624

S/181/60/002/06/12/050  
B122/B063

24.3950

AUTHORS: Gorban, I. S., Timofeyev, V. B.

TITLE: Light Absorption by Cuprous Oxide Films <sup>1</sup>

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 6, pp. 1111-1114

TEXT: The authors used films produced at V. I. Lyashenko's Laboratory of IFAN UkrSSR by sputtering Cu onto a quartz backing and subsequent oxidation of this layer. The absorption spectra were taken by means of an ИСП-51 (ISP-51) spectrograph with a self-collimating chamber of the type УФ-85 (UF-85). The signals were received by a photomultiplier and recorded by a ПСР(PSR) electron potentiometer. The absorption curves were drawn at the temperature of liquid oxygen. Results are shown in Fig. 1. The two curves which correspond to two specimens, have peaks at 4700 Å. The drop of the curve to the long-wave region differs according to the oxygen content of the specimen. The solid specimens exhibited the same general spectrum, but the absorption coefficient of the film specimens was much higher than that of the solid specimens, especially in the long-wave region. This phenomenon is ascribed to lattice defects of the former. By a proper elimination

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Light Absorption by Cuprous Oxide Films

81624

S/181/60/002/06/12/050

B122/B063

of the background it was possible to observe a series of yellow lines. The curve was shifted to longer waves when the experimental temperature was elevated. This shift slightly deviated from linearity. This deviation is described as being the mean coefficient of temperature shift (Table). Again, the deviation was greater in the case of films, and is ascribed to their content of stoichiometric oxygen. Unlike the solid specimens, the films were not luminescent. A surface treatment of the solid specimens influenced the fine structure of the spectral distribution of the function of luminescent excitation and the internal photoeffect, as is known from earlier publications. Finally, the authors thank V. I. Lyashenko for supplying the specimens and for his valuable advice. There are 2 figures, 1 table, and 7 references: 6 Soviet and 1 German.

ASSOCIATION: Kiyevskiy gosudarstvennyy universitet im. T. G. Shevchenko  
(Kiyev State University im. T. G. Shevchenko)

SUBMITTED: March 20, 1959

Card 2/2

✓



S/181/60/002/009/040/047/XX  
B004/B070

26.2420

AUTHORS: Gorban', I. S. and Timofeyev, V. B.

TITLE: Polarization in the Absorption Spectrum<sup>1</sup> of the Cubic Cuprous Oxide

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 9, pp. 2077-2078

TEXT: Reference is made to a paper of Ye. F. Gross and A.A. Kaplyanskiy (Ref. 1) according to which the absorption line of the longest wavelength (the first of the yellow hydrogen-like series) of cubic cuprous oxide is polarized. The following gives a summary of the observations in the present paper in connection with the above-mentioned topic: 1) The polarization of this line is confirmed. 2) A quantitative measurement of the absorption at this line in polarized light was made by means of an interferometer and VCT-51 (ISP-51) spectrograph. The results are shown in Fig. 1. The curve 1 represents the absorption when the vibrations of the electric vector are parallel to the (110) plane. The other curves correspond to the absorption with rotation of the polarizer by 10°. No structural changes appear. There is no dichroic splitting. When the plane

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Polarization in the Absorption Spectrum of  
the Cubic Cuprous Oxide

S/181/60/002/009/040/047/XX  
B004/B070

of vibration of the light vector is rotated, the intensity changes according to a cosine law corresponding to a plane polarization. This amounted to about 90%. 3) The polarization was observed in microcrystalline samples of  $\text{Cu}_2\text{O}$  also; this indicates a tendency of orientation of the monocrystalline blocks. The polarization was absent only in samples of very fine crystals. There are 1 figure and 2 Soviet references. ✓c

ASSOCIATION: Kiyevskiy ordena Lenina gosudarstvennyy universitet im.  
T. G. Shevchenko (Kiyev "Order of Lenin" State University  
imeni T. G. Shevchenko)

SUBMITTED: February 22, 1960

Card 2/2

25584  
S/185/60/005/002/021/022  
D274/D304

26.2421

AUTHOR:

Gorban', I.S.

TITLE:

Optical absorption and structure of energy states  
of copper oxide

PERIODICAL:

Ukrayins'kyi fizychnyy zhurnal, v. 5, no 2, 1960,  
281-284

TEXT: The results are given of a quantitative study of absorption spectra of  $\text{Cu}_2\text{O}$  crystals in the visible range. First, absorption curves are shown for specimens with different specific resistance, at room temperature. In the range 6730 - 6100 Å, the absorption depends on the dark conductivity of the specimen; in this range the absorption is inversely proportional to specific resistance. It is noted that the absorption in this range is due to impurity centers of the acceptor type, whose concentration is uniquely determined by residual oxygen. Further, results are given for a temperature of -180°C. The absorption due to acceptor-type centers, becomes weaker. The intensity of the peaks of the yellow series does not de-

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S/185/60/005/002/021/022  
D274/D304

# Optical absorption...

pend on the impurity concentration. The independence - of the intensity of the structural spectrum - of impurity concentration, at low temperatures and at the longwave edge of the principal band, shows that these band series are due to self-absorption of the crystal. The fact that two hydrogen-like series (yellow and green) are observed, is explained by a splitting of the valence zone due to the spin-orbit coupling of the 3d electrons of copper. S.O. Moskalenko (Ref. 10 FTT, being printed) has shown that the 3d-shell of  $\text{Cu}^+$  in  $\text{Cu}_2\text{O}$  has to be assumed as split into no less than three subzones. The frequency dependence of the coefficient of continuous absorption is given (for the yellow series). It follows from the results given that the structure of the long-wave absorption edge is due to three types of direct "forbidden" transitions. The continuum of the red series lies in the region of the yellow-series absorption bands. The results obtained do not permit ascertaining the nature of the upper component of the valence subzone and of the red series corresponding to it. Three possible reasons for its formation are given. In conclusion,  $\text{Cu}_2\text{O}$  ought to contain no less than 4 types of carriers. On comparing the intensity of the three series, it is noted that the

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Optical absorption...

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valence subzones which are responsible for the yellow- and green series, have a great density of energy states; this corresponds to the considerable effective masses of carriers; this property is important as lying at the basis of the spectral distribution of photoconductivity. There are 2 figures and 14 references; 9 Soviet-bloc and 5 non-Soviet-bloc. The references to the English-language publications read as follows: J. Bloem, Philips Res. Repts., 13, 167, 1958; R.J. Elliot, Phys. Rev., 108, 6, 1384, 1957.

ASSOCIATION: Kyyvs'kyy ordena Lenina derzhavnyy universytet im. T.G. Shevchenka (Kiyev Order of Lenin State University im. T.G. Shevchenko)

SUBMITTED: November 28, 1959

Card 3/3

6.3300

26600

S/185/60/005/003/016/020  
D274/D303

AUTHORS: Gorban', I.S., Rud'ko, S.M. and Shyshlovs'kyi, O.A.

TITLE: Wavelength-independence of quantum yield of infrared  $\text{Cu}_2\text{O}$ -luminescence during excitation in the region of exciton absorption spectra

PERIODICAL: Ukrayins'kyi fizychnyy zhurnal, v. 5, no. 3, 1960, 420-422

TEXT: The dependence is studied of the intensity of infrared luminescence of  $\text{Cu}_2\text{O}$  on the wavelength during excitation in the region of the yellow and green hydrogenic series. In literature, there is no common viewpoint regarding the mechanism of excitation-energy transmission to the local impurity-centers which cause the luminescence. A quantitative study of the  $\text{Cu}_2\text{O}$  absorption-spectrum at liquid-air temperature, showed that the long-wave edge of the eigen-absorption band has a complex structure. In the present study, a lamp of 300 watt was used as a light source. Then the light passed

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D274/D303

Wavelength independence of quantum...

through a monochromator and onto a photomultiplier whose signal was amplified and recorded by electronic potentiometer PSP-1. The measurements were conducted at liquid-air temperature. A figure shows the intensity plotted vs. wavelength (in Å). The spectrum was obtained from a specimen 50  $\mu$  thick. From the figure it is evident that stronger luminescence corresponds to greater absorption. It was established that the dependence of luminescence on wavelength does not have a structure corresponding to the narrow hydrogenic series of exciton absorption. The investigation shows that the intensity of luminescence does not depend on the nature of the exciting light. The processes involved in the luminescence can be explained by assuming an exciton mechanism of energy transmission to the luminescence centers. Excitation by carriers is likely owing to the size of the exciton radius. The lifetime of the carriers in the conduction zone is very short; this may be the reason for the small quantum-yield of photoconductivity in  $\text{Cu}_2\text{O}$  which agrees with the results of earlier investigations. In conclusion, the author considers that a complete solution of the problem would

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26600

Wavelength independence of quantum...

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require further experimental results. There is 1 figure and 6 references: 5 Soviet-bloc and 1 non-Soviet-bloc. The reference to the English-language publication reads as follows: J. Bloem, Philips Research Reports, 13, no. 2, 167-193, 1958.

ASSOCIATION: Kyivsk'kyi derzhavnyi universytet im. T.G. Shevchenka (Kiev State University im. T.G. Shevchenko)

SUBMITTED: December 31, 1959

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GORBAN', I.S.; TIMOFEEV, V.B.

Properties of the longest wavelength line in the structural  
absorption of  $\text{Cu}_2\text{O}$ . Opt. i spektr. 9 no.4:482-486 0 '69.  
(MIRA 13:11)

(Copper oxide--Spectra)

S/058/62/000/006/031/136  
A061/A101

AUTHORS: Gorban', I. S., Timofeyev, V. B.

TITLE: Light absorption by cuprous oxide films

PERIODICAL: Referativnyy zhurnal, Fizika, no. 6, 1962, 29 - 30, abstract 6V200  
("Visnyk Kyivs'k. un-tu", 1960 (1961), no. 3, ser. astron., fiz. ta  
khimiyi, no. 2, 21 - 24, Ukrainian; Russian summary)

TEXT: The absorption spectra of films and bulky crystals of cuprous oxide were confronted at room and low ( $-180^{\circ}\text{C}$ ) temperatures. The broad-band structure of the  $\text{Cu}_2\text{O}$  absorption spectrum was established. Owing to the greatly disordered state of the crystal lattice, the narrow-band exciton structure is absent in absorption spectra of cuprous oxide films. ✓

[Abstracter's note: Complete translation]

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38050 R  
S/051/60/009/006/009/013  
E032/E314

26.2421

AUTHOR: Gorban', I.S.

TITLE: A Quantitative Study of the Absorption Spectrum of Cuprous Oxide

PERIODICAL: Optika i spektroskopiya, 1960, Vol. 9, No. 6, pp. 759 - 764

TEXT: The results now reported were first presented at a session of the Commission for Semiconductors of the AS Ukrainian SSR, which was held in August, 1959, in Odessa. In order to obtain a definitive explanation of the hydrogenic series in the spectrum of cuprous oxide, the present author has carried out quantitative measurements which have provided information about the dependence of the absorption line intensities on impurity concentrations. He has also investigated regularities in the distribution of intensities among the absorption bands of a given series and between different series. About thirty series of mono- and polycrystalline specimens of cuprous oxide with differing dark electrical conductivities were used. It turned out that the dark conductivity of the specimens and the structure of their absorption spectrum were

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A Quantitative Study ....

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EO32/E314

very dependent on the method of preparation of the specimens. The measurements were carried out with the aid of the MCT-51 (ISP-51) spectrograph with an autocollimating camera YQ-85 (UF-85). The intensities were measured with a special photoelectric attachment. A special exit slit was mounted in the plane in which the plate-holder is usually located and was followed by a photomultiplier. The signal from the photomultiplier was amplified and then recorded by pen-recorder. An example of a recorded spectrum showing the absorption band of  $\text{Cu}_2\text{O}$  is shown in Fig. 1. As can be seen, there are four absorption bands belonging to the yellow series which is observed in the spectrum of a cuprous-oxide plate 15  $\mu$  thick and cooled down to  $-180^\circ\text{C}$  in a special cryostat. Fig. 2 shows three absorption curves in the region of the long wavelength absorption edge at room temperatures. Curves 1, 2 and 3 correspond to specimens with the following values of dark resistivity:  $1.26 \times 10^3$ ,  $1.11 \times 10^4$  and  $1.02 \times 10^6$ , respectively (the units are ohm.cm). Fig. 3 shows the

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A Quantitative Study ....

S/051/60/009/006/009/015  
E032/E514

absorption curves at  $-180^{\circ}\text{C}$  in the region of the yellow and green series for specimens with differing conductivities. Curves 1, 2, 3 and 4 correspond to the following values of dark resistivity:  $1.26 \times 10^3$ ,  $1.11 \times 10^4$ ,  $1.05 \times 10^5$  and  $1.02 \times 10^6$ , respectively (ohm.cm). Fig. 3A shows the overall form of the absorption edge for two specimens, while Figs. 3B and 3C show the absorption curve on a larger scale in the region of the yellow and green series, respectively. Fig. 4 shows the absorption curve corresponding to the first member of the yellow series ( $n = 1$ ). This curve was obtained with the aid of a Fabry-Perrot interferometer for a specimen with  $\rho = 1.95 \times 10^6$  ohm.cm. The table gives the most important characteristics of the yellow hydrogenic series at  $-180^{\circ}\text{C}$ . In this table  $n$  is the principal quantum number,  $\lambda_{\text{max}}$  is the position of the maximum on the wavelength scale,  $k_{\text{max}}$  is the absorption coefficient at the maximum,  $\Delta$  is the halfwidth of the band,  $S_n/S_2$  is the ratio of the area under the  $n$ -th

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A Quantitative Study ....

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E032/E314

band to the area under the band with  $n = 2$ ,  $k_n/k_2$  is the corresponding ratio of absorption coefficients at the maximum. It is argued on the basis of the results now reported that the hydrogen-like series of bands which are observed at the fundamental absorption edge are due to absorption by the lattice and not by the impurities. The structure of the fundamental edge in the spectrum of cuprous oxide can be explained on the assumption that the absorption is associated with transitions between states of the same parity. Acknowledgments to A.A. Shishlovskiy, K.B. Topygo and S.A. Moskalenko for their advice. There are 4 figures, 1 table and 13 references: 9 Soviet and 4 non-Soviet. The English-language reference quoted is: Ref. 10 - R.J. Elliott, Phys. Rev., 108, 1384, 1957.

SUBMITTED: November 26, 1959

Card 4/84

SHISHLOVSKIY, Aleksandr Andreyevich. Prinimali uchastiye: KONDILENKO,  
I.I., dotsent; GORBAN', I.S., dotsent. VERES, L.F., red.;  
RAUTIAN, S.G., red.; MURASHOVA, N.Ya., tekhn.red.

[Applied physical optics] Prikladnaya fizicheskaya optika.  
Moskva, Gos.izd-vo fiziko-matem.lit-ry, 1961. 822 p.  
(MIRA 14:3)

(Optics, Physical)

GORBAN', I.S.; GRITSENKO, Yu.I.; RUD'KO, S.N.

Photoluminescence and recombination of current carriers in  
cuprous oxide crystals. Fiz.tver.tela 3 no.7:2147-2153 J1 '61.  
(MIRA 14:8)

1. Kiyevskiy gosudarstvennyy universitet imeni T.G.Shevchenko.  
(Cuprous oxide crystals) (Photoelectricity)



32070

S/181/61/003/012/004/028

B102/B108

24.3500 (1137, 1138)

AUTHORS: Gorban', I. S., and Timofeyev, V. B.

TITLE: Exciton-phonon absorption spectrum in  $\text{Cu}_2\text{O}$  crystals

PERIODICAL: Fizika tverdogo tela, v. 3, no. 12, 1961, 3584 - 3588

TEXT: The absorption spectrum of  $\text{Cu}_2\text{O}$  shows two steps, one below the line  $n=1$ . On the nature of the latter there exist only hypotheses. The authors studied the temperature dependence of light absorption in order to solve the problem of the steps and the continuous absorption below the yellow and green series. Transmission measurements were carried out with a spectrometer with plane diffraction grating. The spectral width of its slit was  $0.45 \text{ \AA}$  at temperatures ranging from that of liquid air to  $+20^\circ\text{C}$ . The absorption coefficients were calculated for each frequency from the intensity ratio of the transmitted to the incident light, without considering reflection. Special measurements showed that the reflection coefficient near the steps was independent of frequency and did not

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S/181/61/003/012/004/028

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Exciton-phonon absorption ...

affect the results. Temperature and frequency dependence of the absorption coefficient at the first and second steps are given by

$$(1) \quad \Delta k_1 = a_1 \frac{1}{e^{\frac{h\nu_\phi}{kT}} - 1} (\nu - \nu_0 + \nu_\phi)^{1/2},$$

$$(2) \quad \Delta k_2 = a_1 \frac{1}{e^{\frac{h\nu_\phi}{kT}} - 1} (\nu - \nu_0 + \nu_\phi)^{1/2} + a_2 \frac{e^{\frac{h\nu_\phi}{kT}}}{e^{\frac{h\nu_\phi}{kT}} - 1} (\nu - \nu_0 - \nu_\phi)^{1/2},$$

$\nu_0$  denotes the frequency of the line  $n=1$ ;  $\Delta k = k_\nu - k_\nu^0$ . Frequency and temperature dependence of light absorption at the steps agrees with the theory of J. Elliott (Phys. Rev. 108, 6, 1957) if the steps are assumed to be caused by exciton-phonon excitation of the crystal. The long-wave step belongs to excitation of the exciton state  $n = 1$  with phonon absorption, the short-wave step to light-quantum absorption exciting the same exciton states with phonon production. The frequency dependence

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Exciton-phonon absorption ...

of absorption satisfies (1) and (2) only at low temperatures. It is possible to estimate the relaxation time of exciton excitations from the half-width of the curve indicating the departure of (1) and (2) from the true behavior. In the temperature investigated range it is between  $0.38 \cdot 10^{-11}$  and  $0.16 \cdot 10^{-11}$  sec. The phonon frequency  $\nu_\phi$  equals the half-width of the free part of the first step and does not depend on temperature. The spectrum corresponding to exciton-phonon excitation in  $\text{Cu}_2\text{O}$  is continuous in a wide range of wavelengths. A similar exciton mechanism was proposed by V. P. Zhuze and S. M. Ryvkin (DAN SSSR, 77, 2, 241, 1951) for photoconductivity and by Yu. I. Karkhanin and V. Ye. Lashkarev (DAN SSSR, 97, 1007, 1954) for photoluminescence. Ye. K. Frolova is mentioned. There are 4 figures, 1 table, and 15 references: 11 Soviet and 4 non-Soviet. The three references to English-language publications read as follows: J. Elliott. Phys. Rev. 108, 6, 1957; P. W. Baumeister. Phys. Rev. 121, 2, 1960; G. Macfarlane et al. Advances semic. science, 1958.

ASSOCIATION: Kiyevskiy gosudarstvennyy universitet im. T. G. Shevchenko  
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Exciton-phonon absorption ...

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S/181/61/003/012/004/028  
B102/B108

(Kiyev State University imeni T. G. Shevchenko)

SUBMITTED: June 28, 1961

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GORBAN' I. S.

34432  
S/185/61/006/006/009/030  
D299/D304

243500

AUTHORS: Horban', I.S., and Rud'ko, S.M.

TITLE: Absorption- and luminescence spectra of  $\text{HgJ}_2$  crystals

PERIODICAL: Ukrayins'kyy fizychnyy zhurnal, v. 6, no. 6, 1961,  
764 - 767

TEXT: Exciton theory in the effective-mass approximation is considered for the case of non-hydrogenic exciton spectra, as well as the following related problems: Transformation of exciton-excitation energy into radiation (due to direct transitions from exciton levels), conditions for transitions without radiation, and the interaction between exciton excitation and lattice defects. The absorption- and luminescence spectra were measured at temperatures of 20, 77 and 100°K. The luminescence was studied on single crystals, whereas the absorption spectra were studied on polycrystalline specimens. A figure shows the obtained spectra. The high values of the absorption coefficients ( $10^4 \text{ cm}^{-1}$ ) and the obtained reproducibility of data for various specimens, show that the absorption spectrum is

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of crystalline type. The high values of the absorption coefficients show that the corresponding optical transitions are direct allowed transitions. The spectral band of longest wavelength corresponds to transitions to the lowest exciton-state. It is important to calculate the oscillator strength  $f$  for this band; it was found that  $f = 6 \cdot 10^{-4}$  to  $4 \cdot 10^{-4}$  (for temperatures between 20 and 100°K). Knowing  $f$ , it is possible to determine the dissociation energy of excitons  $G_{\text{exc}}$ ; this was found to be 0.14 - 0.17 ev., very close to the values of the spectral distance (0.14 - 0.15 ev) between the maximum of the band and the beginning of the continuous absorption (which increases sharply in the shortwave side of the measured spectrum). The obtained results lead to the conclusion that the continuous absorption is due to interzone transitions. Knowing  $f$ , it is also possible to determine the order of magnitude of the diameter of exciton excitation and its reduced effective mass. Another figure shows the energy distribution in the luminescence spectrum, which has 2 bands, corresponding to transitions between exciton states and to luminescence of local centers. The experimentally measured lifetime of excitons and the calculated one differed by an or-

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Absorption- and luminescence ...

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der of magnitude. (This discrepancy is explained). By extending the above considerations to the ratios of luminescence-band intensities, it is possible to quantitatively determine the efficiency of radiationless transitions, of exciton radiation, and of exciton energy transfer to local centers. The obtained experimental results are proof of the great significance of exciton processes in the transformation of the excitation energy of  $\text{HgJ}_2$  crystals, into luminescence. There are 2 figures and 9 references: 5 Soviet-bloc and 4 non-Soviet-bloc (including 1 translation). The references to the English-language publications read as follows: R.G. Elliot, Phys. Rev., 108, 6, 1957; D.L. Dexter, Phys. Rev., 101, 48, 1956; T. Moss Photocond. in ebm., London, 1952. ✓

ASSOCIATION: Kyivsk'yy derzhuniversytet im. T.H. Shevchenka (Kyiv State University im. T.H. Shevchenko)

Card 3/3

89235

9.4/60 (415. 1137,1395)

S/048/61/025/001/001/031  
B029/B067

AUTHORS: Gorban', I. S., Rud'ko, S. N., and Shishlovskiy, A. A.

TITLE: Luminescence of semiconducting crystals on excitation in the region of the discrete structure of the absorption spectrum

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, v. 25, no. 1, 1961, 6-12

TEXT: According to the authors, the intensity of recently observed short-wave luminescence bands of  $\text{Cu}_2\text{O}$  (Ref. 5) is largely dependent on the production process and the heat treatment of the specimens. Fig. 1 shows luminescence spectra of  $\text{Cu}_2\text{O}$  crystals with different resistivities. The spectra were taken at  $20^\circ\text{K}$  and  $77^\circ\text{K}$ . The luminescence of  $\text{Cu}_2\text{O}$  crystals is mainly caused by impurity centers. Radiation 1 is caused by copper vacancies, whereas luminescence 2 and 3 are caused by oxygen vacancies. A temperature change strongly reduces the luminescence intensity of the bands in the short-wave region of the spectrum. In Fig. 2, A, schematically

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Luminescence of semiconducting crystals ....

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B029/B067

illustrates the ground states of defects of the type of copper vacancies. Levels  $A_2$  and  $A_3$  belong to the centers of the type of oxygen vacancies;  $m_1$  and  $m_2$  are the excited states of the centers. The mechanism of excitation-energy transfer to impurity centers on illumination of the crystal with frequencies of its own bands is essential for the explanation of luminescence and photoconductivity. For this purpose, the authors analyze some experimental data. Fig. 3 illustrates quantitative measurements of the absorption spectrum at liquid-air temperature, i.e., of absorption spectrum (1), excitation spectra of  $Cu_2O$  luminescence for radiation 1(2), as well as for bands 2 and 3(3). This can be explained by two mechanisms: 1) excitation energy is transferred to impurity centers by carriers and excitons with the same efficiency. 2) Impurity centers are excited by excitons which are formed directly during light absorption or through conduction bands by interaction of carriers of opposite sign. According to the authors, the second mechanism is more probable. In this connection, reference is made to N. A. Tolstoy's ideas. If  $W_{i\phi} < W_i$ , the following

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Luminescence of semiconducting crystals ....

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relation holds for the temperature dependence of the exciton lifetime:

$$\tau = \frac{1}{\beta + W_1 N_1 + (W_2 + W_3) N - (W_1 - W_1 \phi) C_1 e^{-\epsilon_1/kT} - (W_2 - W_2 \phi) C_2 e^{-\epsilon_2/kT} - (W_3 - W_3 \phi) C_3 e^{-\epsilon_3/kT}}$$

For the exciton yield of the i-th band  $\eta_i = W_i (N_i - C_i e^{-\epsilon_i/kT}) \tau$  holds with  $i = 1, 2, 3$ ;  $N_i$  denotes the concentration of lattice defects per unit volume;  $N_i^-$  is the number of occupied levels;  $W_i$  are the probabilities of collision between excitons and vacancies;  $W_i \phi$  are the collision probabilities of an exciton with occupied acceptors;  $\beta$  is the decay probability of an exciton without collision with a defect. Furthermore,  $N_1^- = C_1 e^{-\epsilon_1/kT}$ ,  $N_2^- = C_2 e^{-\epsilon_2/kT}$ ,  $N_3^- = C_3 e^{-\epsilon_3/kT}$ .

The conclusions drawn by the authors agree with the experimental results obtained and help to explain some hitherto inexplicable details. The authors then describe luminescence and absorption

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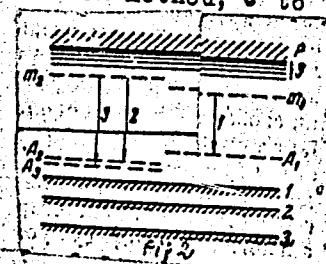
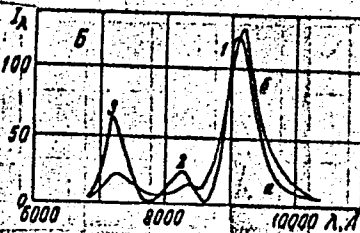
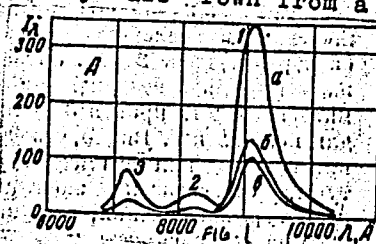
89235

Luminescence of semiconducting crystals ....  
(Card 4/5)

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properties of some other crystals. Fig. 4 shows the energy distribution in the two shortest short-wave luminescence bands of  $\text{HgI}_2$ . The spectral properties of  $\text{CdS}$ ,  $\text{ZnS}$ ,  $\text{PbI}_2$  crystals are similar to those of  $\text{HgI}_2$ . According to the results obtained, the structure of the excitation spectrum cannot be fully related to the different absorption character. This is the reproduction of a lecture read at the Ninth Conference on Luminescence (Crystal Phosphores), Kiyev, June 20-25, 1960. There are 5 figures, 1 table and 17 references: 12 Soviet-bloc and 5 non-Soviet-bloc.

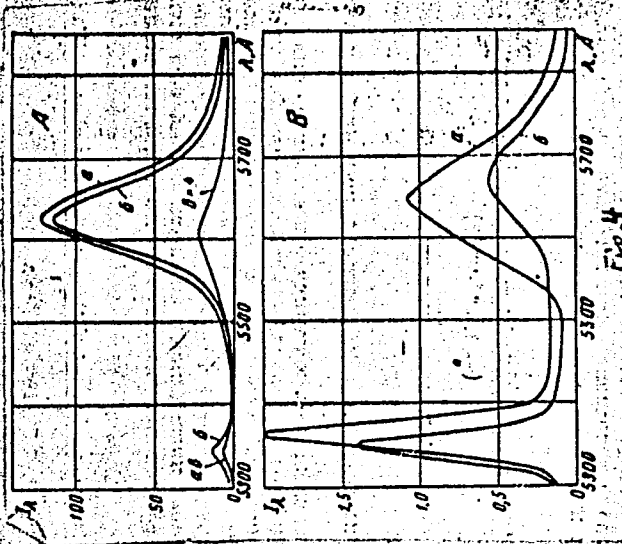
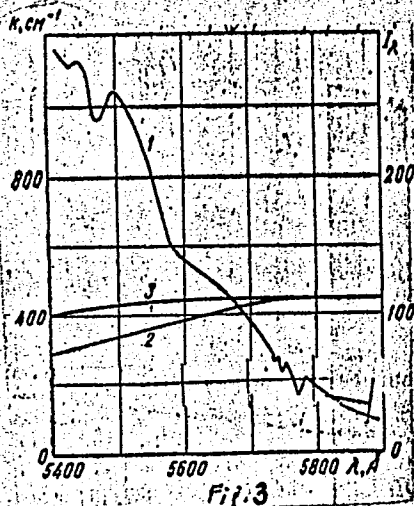
Legend to Fig. 4: Low-temperature spectra of  $\text{HgI}_2$ ; A)  $T = 20^\circ\text{C}$ , B)  $T = 77^\circ\text{C}$ ; curves a and b refer to crystals grown by the sublimation method, c to crystals grown from a solution.



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B029/B067

Luminescence of semiconducting crystals ...



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GORBAN', I.S.; TIMOFEYEV, V.B.

Complex refraction in copper oxide single crystals. Dokl. AN  
SSSR 140 no.4:791-793 0 '61. (MIRA 14:9)

1. Kiyevskiy gosudarstvennyy universitet im. T.G.Shevchenko.  
Predstavleno akademikom I.V.Obreimovym.  
(Copper oxide crystals--Optical properties)

243500

S/051/62/012/005/010/021  
E032/E414AUTHORS: Gorban', I.S., Rud'ko, S.N.TITLE: Absorption and photoluminescence spectra of  $\text{HgI}_2$  crystals

PERIODICAL: Optika i spektroskopiya, v.12, no.5, 1962, 610-615

TEXT: The spectra were measured at 20, 77 and about 100°K using a mirror spectrometer with a plane diffraction grating. The linear dispersion was about 16 Å/mm. A ФЭУ-17 (FEU-17) photomultiplier was used as the detector. The photoluminescence was measured in single crystals and the absorption spectra were determined for very thin polycrystalline plates. Fig.1 shows the absorption spectrum (3) and the energy distribution in the photoluminescence spectrum (1,2) of the red modification of  $\text{HgI}_2$  at 20°K. Curve 2' in this figure shows the peak marked 2 on a larger scale. Fig.2 shows the energy distribution in the photoluminescence spectrum of  $\text{HgI}_2$  (I - 20°K, curves a and б are for single crystals (obtained from the vapour phase) and refer to different portions of the original material; curve 3 represents the luminescence of a crystal grown from solution; Card 1/8-2

Absorption and photoluminescence ...

S/051/62/012/005/010/021  
E032/E414

II - photoluminescence spectrum of specimen a). It is argued that the discrete structure of the absorption spectrum is associated with exciton states. The photoluminescence spectrum is due to transitions from exciton levels and the emission of local centres of the lattice-defect type. Analysis of the absorption spectra at 20°K showed that the exciton diameter and its effective mass are approximately  $1.55 \times 10^{-7}$  cm and  $0.43 m_e$  respectively. The general conclusion is that exciton processes play a major role in the transformation of the energy of excitation of  $\text{HgI}_2$  crystals into photoluminescence. There are 2 figures.

4

SUBMITTED: March 31, 1961

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33434

S/048/62/026/001/010/018  
B117/B102

24.3500 (1137,1138,1144)

AUTHORS: Belyy, M. U., Gorban', I. S., and Shishlovskiy, A. A.

TITLE: Photoluminescence of heavy-metal halides and semiconductor crystals

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Seriya fizicheskaya, v. 26, no. 1, 1962, 103 - 112

TEXT: 1. Photoluminescence of heavy-metal halides. It has been found at the Kiyevskiy gos. universitet im. T. G. Shevchenko (Kiyev State University imeni T. G. Shevchenko) that luminescence in alkali halide crystal luminophores takes place even without any ion association. Unlike Tl, Pb, and Sn the discovered luminescence of tellurium, antimony, and bismuth halides is observable at low temperatures only. An optical method developed by the authors themselves [Abstracter's note: details not given] was applied to determine the composition of the complexes forming in thallium and lead halide solutions, and the respective absorption spectra were calculated. Each type of complex is shown to have its own absorption spectrum. The shape of the absorption band is equal for each

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S/048/62/026/001/010/018  
B117/B102

Photoluminescence of heavy-metal...

complex, and this points to one and the same absorption center, namely, the heavy-metal cation. With the exception of the thallium ion, heavy-metal cations are not luminescent in the hydrated state. However, if halogen ions are introduced into the aqueous solution, a luminescence characteristic of the metal salt concerned is brought forth. Complexes of differing compositions have the same luminescence spectrum in the heavy metal concerned. Their absorption spectra, however, differ noticeably as to wavelength. Unlike the luminescence spectra they are hardly affected by temperature. On a drop of temperature, the luminescence spectrum first shifts toward the longwave, and then sharply toward the shortwave range. The change of direction coincides with vitrification. The luminescence yield of the solutions examined grows sharply with a drop of temperature, and on the passage from one halogen to another it decreases in the following sequence:  $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{I}^-$ . In acid media it is noticeably decreased by shortwave-ultraviolet irradiation. It has been found that luminescence is caused by s-electrons. As for thallium and lead halide solutions, also d-electrons are probably involved. A comparison between absorption and luminescence spectra of liquid solutions and between alkali halide crystal phosphors similar in composition revealed great similarity

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S/048/62/026/001/010/018  
B117/B102

Photoluminescence of heavy-metal...

between their absorption and luminescence centers. 2. Photoluminescence of semiconductors. The authors' investigation chiefly yielded quantitative data regarding the absolute values of the absorption coefficients and the relative energy distribution in the emission spectra, thus permitting the interpretation of the latter.  $\text{Cu}_2\text{O}$ ,  $\text{PbI}_2$ ,  $\text{SiC}$ , and  $\text{HgI}_2$  crystals were examined. It has been found that the character of photoluminescence in semiconductors is determined by the characteristics of optical transitions related to light absorption. The particular character of the structure of natural energy states in crystals manifests itself in that the energy distribution in the photoluminescence spectrum in straight forbidden and oblique transitions is determined by local centers. In the case of a longwave edge structure due to straight allowed transitions, a natural radiation of crystals is observable besides the luminescence of local centers. Intense natural radiation occurs only if exciton transitions are of high probability and the local centers are not too concentrated. A study of optical properties of some semiconductors showed that the exciton structure of the absorption spectrum can be observed under certain conditions, namely, at low

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Photoluminescence of heavy-metal...

33434  
S/048/62/026/001/010/018  
B117/B102

temperatures and on sufficiently large crystals. Based on the properties of the longwave edge fine structure, a classification and a description of the character of optical transitions are possible. The energy distribution in the emission spectrum and its dependence on the wavelength of excitation are strongly influenced by the character of natural energy states of crystals, and especially by the exciton processes taking place in the latter. There are 7 figures, 3 tables, and 22 references: 16 Soviet and 6 non-Soviet. The four most recent references to English-language publications read as follows: P. W. Baumeister, Phys. Rev., 121, 2, (1961); G. G. Macfarlane a. oth., J. Chem. Phys. Solids, 2, 388 (1959). Phys. Rev., 108, 6 (1957); C. D. Clarc, J. Chem. Phys. Solids, 2, 481 (1959).

ASSOCIATION: Kiyevskiy gos. universitet im. T. G. Shevchenko (Kiyev  
State University imeni T. G. Shevchenko)

Card 4/4

GORBANI, I.S.

Study of the long-wave self-absorption edge of an antimony-cesium photocathode. Izv. AN SSSR. Ser.fiz. 26 no.11:1376-1382 N '62.

(MIRA 15:12)

1. Kiyevskiy gosudarstvennyy universitet im. T.G. Shevchenko.  
(Cathodes) (Spectrum analysis) (Photoelectricity)

S/101/63/005/004/001/047  
B102/B186

AUTHORS: Gorban', I. S., Timofeyev, V. B., and Frolova, Ye. P.

TITLE: Spectroscopic observation of exciton scattering in a crystal

PERIODICAL: Fizika tverdogo tela, v. 5, no. 4, 1963, 977 - 981

TEXT: The authors investigated the relaxation effects of exciton states in  $\text{Cu}_2\text{O}$  crystals wherein exciton-phonon absorption spectra may be observed (FTT, 3, 12, 1961). These spectra have a steplike structure, caused by the excitation of the  $n=1$  exciton state of the yellow series with optical phonon ( $105 \text{ cm}^{-1}$ ) absorption or emission. The exciton-phonon step broadens in consequence of relaxation processes occurring on the establishment of the thermodynamic equilibrium in the exciton band. The broadening is characterized by the deviation ( $\Delta\nu$ ) of the frequency dependence of the absorption coefficient near the step edges from the regular form (Phys. Rev. 108, 1384, 1957), which arises at sufficiently high temperatures. The blurring of the edges,  $\Delta\nu \sim 1/\tau$ , ( $\tau$  is the relaxation time) was plotted as a function of temperature between 100 and  $400^\circ\text{K}$ ;  $\Delta\nu$  proved to be almost independent of temperature up to  $\sim 280^\circ\text{K}$ , after which it rose rapidly. From Card 1/2

Spectroscopic observation of...

S/181/63/005/004/001/047  
B102/B186

this behavior it was concluded that the excitons - as also the carriers - are mainly scattered from lattice vibrations. The exciton diffusion parameters are estimated, whence a close relation was found to exist, between the properties of the exciton-phonon spectrum and the kinetics of the photoluminescence of impurity centers in  $\text{Cu}_2\text{O}$ . The exciton diffusion coefficient is  $D = 0.7 \text{ cm}^2/\text{sec}$  ( $T = 293^\circ\text{K}$ ) and the hole diffusion coefficient is  $0.25 \text{ cm}^2/\text{sec}$  for  $\mu = 100 \text{ cm}^2/\text{v}\cdot\text{sec}$ . There are 2 figures.

ASSOCIATION: Kiyevskiy gosudarstvennyy universitet im. T. G. Shevchenko  
(Kiyev State University imeni T. G. Shevchenko)

SUBMITTED: September 21, 1962

Card 2/2

L 13038-63 EWT(1)/EWP(q)/EWT(m)/BDS AFFTC/ASD/ESD-3 JD/WH/  
IJP(C)

ACCESSION NR: AP3000615 S/0181/63/005/005/1368/1372 64

AUTHOR: Gorban', I. S.; Rud'ko, S. N. 60

TITLE: Optical properties of silicon-carbide crystals 21

SOURCE: Fizika tverdogo tela, v. 5, no. 5, 1963, 1368-1372

TOPIC TAGS: absorption band, p-n junction, SiC, absorption edge, direct transition, indirect transition, phonon, luminescence, photoluminescence, silicon-carbide crystal, SiC crystal

ABSTRACT: The authors have investigated the structure of a long-wave edge of the proper absorption band through a wide temperature range for artificial and commercial-grade SiC crystals. The structure of the long-wave edge is determined by indirect transitions in which three types of phonons participate (with energies of 0.04, 0.067, and 0.1 ev). The reflection spectrum of SiC was studied in ultraviolet light, and direct transitions were detected. The energy gap between the extremes represented by direct and indirect transitions is about 1 ev. SiC crystals possess two types of luminescence, one originating in the body of the crystal, the other associated with radiative recombination of carriers within p-n junctions, taking place near the surface. The excitation function of photo-

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L 13038-63

ACCESSION NR: AP3000615

luminescence indicates that, deep within the absorption band, SiC crystals are characterized by excitations which are free to transfer energy to impurity centers of luminescence until thermodynamic equilibrium is reached in the conduction band. "In conclusion, the authors consider it their pleasant duty to thank S. M. Genkina, S. A. Dobrolezh, and V. Z. Smushkevich for their kindness in furnishing the silicon-carbide crystals used in the investigation." Orig. art. has: 5 figures.

ASSOCIATION: Kiyevskiy gosudarstvennyy universitet im. T. G. Shevchenko  
(Kiev State University)

SUBMITTED: 15Sep63

DATE ACQ: 11Jun63

ENCL: 00

SUB CODE: 00

NO REF SOV: 006

OTHER: 008

Card 2/2



S/185/63/008/031/014/024  
D234/D308

GORBAN, I. S.

AUTHORS: Gorbani', I. S., <sup>c</sup> Brytsenko, Yu. I. and Rud'ko, S. M.  
TITLE: Optical properties of admixture centers and the photoconductivity of cuprous oxide  
PERIODICAL: Ukrayins'kyi fizychnyy zhurnal, v. 8, no. 1, 1963, 96-100

TEXT: The authors measured absorption spectra of admixtures, energy distribution in the photoluminescence spectrum and special dependences of photoconduction kinetics in  $\text{Cu}_2\text{O}$  specimens annealed under various conditions. Results are given for three typical specimens annealed in oxygen at 1) 1.0 mm Hg, 1070°C, 2) 0.002 mm Hg, 700°C, 3) 0.0010 mm Hg, 800°C. Specimen no. 1 exhibits photoconductivity at the long-wave end of the band, no. 3 has maximum photoconductivity at 7200 Å, and no. 2 has intermediate properties. The results are discussed in detail. The intensity of admixture absorption is correlated with that of short-wave photoluminescence bands, which are probably associated with oxygen

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Optical properties of ...

S/185/63/008/001/014/024  
D234/D308

vacancies. The latter cause an admixture photoconductivity in the long-wave part of the spectrum, characterized by long relaxation times. The interaction of excitons with different admixture centers is found to be selective. There are 3 figures.

ASSOCIATION: Kyivskyy derzhuniversytet im. T. H. Shevchenka  
(Kiev State University im. T. H. Shevchenko)

SUBMITTED: July 2, 1962

Card 2/2

ACCESSION NR: AP4032868

S/0051/64/016/004/0638/0641

AUTHOR: Gorban', I.S.; Timofeyev, V.B.

TITLE: New data on the absorption spectrum of lithium fluoride crystals

SOURCE: Optika i spektroskopiya, v.16, no.4, 1964, 638-641

TOPIC TAGS: lithium compound, luminescence spectrum, absorption spectrum, color center, F center

ABSTRACT: A distinctive characteristic of LiF crystals, as members of the general class of alkali halide crystals, is that, in addition to the systems of broad absorption and photoluminescence bands typical of all alkali halide crystals, LiF crystals also exhibit narrow absorption and luminescence bands, the origin of which is still obscure. Accordingly, in the present work there was investigated the absorption spectrum of x-ray irradiated (colored) lithium fluoride crystals cooled to 20°K. Three structure groups were discerned; the wavenumbers of the head lines are 19 104, 20 516, and 21 063 cm<sup>-1</sup>. All but the first disappear with warming to 77°K. At 20°K the intensity ratios of the head lines are 1:0.17:0.033, and are independent of the degree of x-irradiation, polarization of the light, etc. Comparison with the

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ACCESSION NR: AP4032868

luminescence spectrum (obtained by other investigators at 77°K) made it possible to identify in the latter a series of lines in mirror symmetry with the absorption series. The results are interpreted on the assumption that the observed lines are associated with electronic-vibrational transitions in complex color centers in LiF. In conclusion, it is noted that in addition to the above mentioned line groups (series) there were observed in the absorption spectra of freshly colored LiF crystals several lines in the 19 000 cm<sup>-1</sup> region; these lines are weak and disappear after a few hours; they are attributed to evanescent (time-unstable) centers. Orig.art.has: 2 figures and 1 table.

ASSOCIATION: none

SUBMITTED: 09Sep63

DATE ACQ: 07May64

ENCL: 00

SUB CODE: SS, OP

NR REF SOV: 005

OTHER: 003

Card 2/2

L 10156-63

EWT(1)/EWG(k)/BDS/EEC(b)-2--AFFTC/ASD/ESD-3/

SSD--Pz-4--AT

ACCESSION NR: AP3000320

S/0048/63/027/005/0675/0678

AUTHOR: Gorban', I. S.; Kosarev, V. M.

66  
64

TITLE: Radiative photoluminescence quenching in lead iodide crystals [ Report; Eleventh Conference on Luminescence held at Minsk 10-15 Sept. 1962]

SOURCE: Izvestiya AN SSSR, Seriya fizicheskaya, v. 27, no. 5, 1963, 675-678

TOPIC TAGS: luminescence, radiative luminescence quenching, lead iodide

ABSTRACT: The absorption spectra of lead iodide crystals exhibit structure at the long wavelength edge, which is associated with exciton states. The structure differs for different crystals depending on the method of preparation (growth from melt or sublimation). The same thing is true of the several bands in the luminescence spectrum. The reflection spectra of different crystals are consistent with the absorption spectra. Detailed investigation of the luminescence of PbI sub 2 shows that there exist two types of crystals; one with a double short wavelength band; the other with a single band. The splitting of the short wavelength luminescence band and doubling in the absorption spectrum

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L 10156-63  
ACCESSION NR: AP3000320

2

are attributed to the existence of two modifications in the same crystal, one occupying the bulk of the crystal, the other concentrated at the surface and near dislocations and other defects. This is evinced by photochemical transformations: under continuing UV irradiation at  $77^{\circ}\text{K}$  the greenish emission changes to orange as a result of quenching of the shortest wavelength luminescence band. The time variation is nonlinear; that is, the effect exhibits saturation. Restoration of the quenched luminescence was also studied. It is characterized by an exponential function with the activation energy for thermal destruction of the photochemical quenching centers in the exponent. The activation energy was evaluated. On the basis of the photoluminescence characteristics lead iodide crystals may be classified as photochemically active or inactive. The active ones are capable of "remembering" light signals. Orig. art. has 3 figures.

ASSOCIATION: Kievskiy ordena Lenina gos. universitet im. T. G. Shevchenko (Kiev State University)

SUBMITTED: 00

DATE ACQ: 12Jun63

ENCL: 00

SUB CODE: PH

NR REF SOV: 004

OTHER: 002

gcx/42  
Grd2/2

L 18852-65 EWT(1)/EWT(m)/EWP(t)/EEC(t)/EWP(b) Feb IJP(c)/AFWL/ASD(a)-5/  
IS/mp)-2/ESD/APGC(b)/SSD(c)/ESD(es)/ESD(t) JD S/0181/64/006/008/2389/2392  
ACCESSION NR: AP4043358

AUTHORS: Gorban', I. S.; Dashkovskaya, R. A.

TITLE: Absorption spectrum and optical transitions in  $\text{As}_2\text{S}_3$  crystals B

SOURCE: Fizika tverdogo tela, v. 6, no. 8, 1964, 2389-2392

TOPIC TAGS: arsenic sulfide, single crystal, level transition, light polarization, phonon, exciton, forbidden band, absorption spectrum

ABSTRACT: A study of the long-wavelength edge of the fundamental absorption band of  $\text{As}_2\text{S}_3$  single crystals at 90, 293 and 403K showed the existence of four regions for either of the two polarizations of light ( $E \parallel C$ ,  $E \perp C$ ) incident normally on a mica-type cleavage plane. These regions (numbered in order of decreasing wavelength) exhibited sublinear (1 and 2) and linear (3 and 4) dependences of

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L 18852-65

ACCESSION NR: AP4043358

the absorption coefficient on the frequency of the incident light. Regions 1 and 3 disappeared on cooling to 90K. It was concluded that regions 1 and 2 were due to indirect transitions to exciton states accompanied by phonon absorption and emission respectively, and regions 3 and 4 were due to indirect band-to-band transitions, also accompanied by phonon absorption and emission respectively. The energy of phonons taking part in these indirect transitions was found to be 0.04 eV, corresponding to a characteristic temperature of 465K. The exciton dissociation energies were found to be  $\epsilon_{||} \approx 0.14$  eV and  $\epsilon_{\perp} \approx 0.17$  eV. The forbidden band width decreased from 2.64 eV (for  $E \parallel C$ ) and 2.57 eV (for  $E \perp C$ ) at 90K to 2.365 eV (for  $E \parallel C$ ) and 2.355 eV (for  $E \perp C$ ). It was established that the dichroism of the absorption edge was not so much due to the dichroism of the forbidden band width as to the dependence of the absorption coefficient on the polarization of light. Orig. art. has: 1 figure, 2 formulas, and 1 table.

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L 18852-65

ACCESSION NR: AP4043358

2

ASSOCIATION: Kiyevskiy gosudarstvennyy universitet im. T. G. Shevchenko (Kiev State University); Kiyevskiy tekhnologicheskii institut legkoy promyshlennosti (Kiev Technological Institute of Light Industry)

SUBMITTED: 24Feb64

ENCL: 00

SUB CODE: OP, SS

NR REF SOV: 005

OTHER: 005

Card 3/3

L 20240-65 EWP(e)/EWT(m) AFWL/ASD(a)-5/SSD/BSO/AFETR/AFTC(p)/  
 RAEM(c)/RAEM(a)/ESD(gs)/ESD(t) WH S/0051/64/017/006/0880/0886  
 AFETR ON NRI AP5000547

AUTHOR: Gorban', I. S.; Kononchuk, G. L.

TITLE: Anomalous light dispersion in the R-lines of a ruby and  
 refractional shifting of the laser spectrum

JOURNAL: Optika i spektroskopiya, v. 17, no. 6, 1964, 880-886

TOPIC TAGS: laser, ruby, ruby spectrum, R line, anomalous disper-  
 sion, refraction index, negative dispersion

ABSTRACT: An investigation is made of the variations of the refrac-  
 tion index in the spectral region of ruby R-lines responsible for  
 stimulated emission. The dispersion of dichroism of ruby lines  
 caused by chromium ions was measured at room temperature and at li-  
 quid oxygen temperature using ruby crystals with a 0.3 percent con-  
 centration of chromium. The curves obtained were approximated by  
 formulas with a number of parameters related to the unit density of  
 chromium. These formulas can be used to calculate dispersion curves  
 for ruby R-lines for the two main polarizations and for an arbitrary

Ca. 2 /2

L 20240-65

ACCESSION NR: AP5000547

concentration of chromium. The refractional shifting of a ruby laser spectrum is also considered. A rough estimate shows that variation of the refraction index during the nonstationary mode of operation of a ruby laser will limit the degree of monochromaticity of each spoke. Orig. art. has: 6 figures, 2 tables, and 8 formulas.

ASSOCIATION: none

SUBMITTED: 16Dec63

ENCL: 00

SUB CODE: EC, OP

NO REF SOV: 004

OTHER: 004

ATD PRESS: 3163

Card 2/2

